CLAIMS

1. A generator-motor, comprising:

a motor (50) including a plurality of coils (51 to 53) provided corresponding to a plurality of phases and attaining a function as a motor-generator; and

a control circuit (20) controlling said motor (50); wherein

said control circuit (20) includes

a plurality of arms (23 to 25) provided corresponding to said plurality of coils (51 to 53) respectively and connected in parallel between a positive bus (L1) and a negative bus (L2), and

a first Zener diode (21) connected in parallel to said plurality of arms (23 to 25), between said positive bus (L1) and said negative bus (L2), and

each of said plurality of arms (23 to 25) includes

first and second switching elements (Tr1, Tr3, Tr5; Tr2, Tr4, Tr6) connected in series between said positive bus (L1) and said negative bus (L2), and

a second Zener diode (DT1 to DT3) connected in parallel to said second switching element (Tr2, Tr4, Tr6), between said first switching element (Tr1, Tr3, Tr5) and said negative bus (L2).

2. The generator-motor according to claim 1, wherein

said control circuit (20) is provided in a manner integrated with said motor (50).

3. The generator-motor according to claim 1, wherein

said motor (50) starts an engine (110) mounted on a vehicle or generates electric power by a rotation force of said engine (110).

4. The generator-motor according to claim 1, further comprising an electronic control unit (27 to 30) outputting a control signal to a plurality of first and second

switching elements (Tr1, Tr3, Tr5; Tr2, Tr4, Tr6) included in said control circuit (20), wherein

said first Zener diode (21) is arranged in vicinity of said electronic control unit (27 to 30).

5. The generator-motor according to claim 1, further comprising a fuse (FU1) provided closer to a DC power source (10) than to a positive-side connecting position of said first Zener diode (21).

6. A generator-motor, comprising:

a motor including a rotor (55) and a stator (56, 57) and attaining a function as a motor-generator;

first and second electrode plates (81, 82A to 82C) arranged on an end surface of said motor (50) so as to substantially form a U-shape to surround a rotation shaft of said motor (50);

a polyphase switching element group (Tr1 to Tr6) controlling a current supplied to said stator (56, 57); and

a control circuit (26, 70) controlling said polyphase switching element group (Tr1 to Tr6); wherein

said control circuit (27, 70) is provided on a ceramic substrate (84) arranged in a direction similar to an inplane direction of said first and second electrode plates (81, 82A to 82C) in a substantially U-shaped notch.

7. The generator-motor according to claim 6, wherein

said control circuit (27, 70) is resin-molded.

8. The generator-motor according to claim 6, further comprising a Zener diode (21) protecting said polyphase switching element group (Tr1 to Tr6) against surge,

wherein

said Zener diode (21) is arranged in said notch.

9. The generator-motor according to claim 6, further comprising a capacitive element (22) smoothing a DC voltage from a DC power source (10) and supplying the smoothed DC voltage to said polyphase switching element group (Tr1 to Tr6), wherein

said capacitive element (22) is arranged between said ceramic substrate (84) and said second electrode plate (82A to 82C).

10. The generator-motor according to claim 6, further comprising a field coil control unit (40) controlling current feed to a field coil (54) different from said stator (56, 57), wherein

said field coil control unit (40) is arranged on said ceramic substrate (84).

11. The generator-motor according to claim 6, wherein

a leadframe (86A to 86F) continuing to said first and second electrode plates (81, 82A to 82C) from said ceramic substrate (84) and said first and second electrode plates (81, 82A to 82C) are arranged in an identical plane.

12. A generator-motor, comprising:

a motor (50) attaining a function as a generator-motor;

a plurality of switching elements (Tr1 to Tr6) controlling a current supplied to said motor (50); and

a bus bar (81, 82A to 82C, 83) connecting said plurality of switching elements (Tr1 to Tr6); wherein

a ratio of an area of said bus bar (81, 82A to 82C, 83) to an area of said switching element (Tr1 to Tr6) is at least five.

13. The generator-motor according to claim 12, further comprising a buffer material (812) provided between said bus bar (81, 82A to 82C, 83) and said switching element (Tr1 to Tr6) and absorbing thermal expansion difference between said bus bar (81, 82A to 82C, 83) and said switching element (Tr1 to Tr6).

14. The generator-motor according to claim 12, wherein
said buffer material (812) is made of a copper-based or aluminum-based material.

15. The generator-motor according to claim 12, wherein
said bus bar (81, 82A to 82C, 83) is made of copper.

16. The generator-motor according to claim 12, wherein
said bus bar (81, 82A to 82C, 83) is provided on an end surface of said motor (50) and has an arc shape.

17. The generator-motor according to claim 12, wherein
said bus bar (81, 82A to 82C, 83) includes
a first bus bar (81) implementing a power source line,
a second bus bar (82A to 82C) connected to a coil (51 to 53) of said motor (50), and
a third bus bar (83) implementing a ground line,
said plurality of switching elements (Tr1 to Tr6) include
a plurality of first switching elements (Tr1, Tr3, Tr5) provided on said first bus bar (81), and
a plurality of second switching elements (Tr2, Tr4, Tr6) provided on said second bus bar (82A to 82C), and
said generator-motor (101) further comprises
a plurality of first flat electrodes (91, 93, 95) connecting said plurality of first

switching elements (Tr1, Tr3, Tr5) to said second bus bar (82A to 82C), and

a plurality of second flat electrodes (92, 94, 96) connecting said plurality of second switching elements (Tr2, Tr4, Tr6) to said third bus bar (83).